J. P. Caldwell

Pinworms (Enterobius Vermicularis)

SUMMARY

Pinworm infestation (enterobiasis, syn. oxyuriasis), though not usually dangerous, remains one of the commonest parasitic infections seen by the family physician. Particularly prevalent in the pediatric age group, pinworms also infect adults; in both groups the commonest symptom is pruritus ani. Detailed descriptions of history, life cycle, and epidemiology are given. In addition to hygienic measures useful in treatment, the particulars of drug therapy are also outlined. (Can Fam Physician 1982; 28:306-309).

SOMMAIRE

L'infestation de vers (enterobes, syn. oxyures), quoique généralement pas dangereuse, demeure l'une des infections parasitiques les plus courantes rencontrées par le médecine de famille. Particulièrement répandue chez les enfants, cette infection se trouve aussi chez les adultes; le symptôme le plus commun pour les deux groupes est le prurit anal. L'histoire, le cycle de vie et l'épidémiologie sont décrits de façon détaillée. On y explique les particularités du traitement pharmaceutique de même que les mesures d'hygiène utiles au traitement.

Dr. Caldwell, a certificant of the College, practices family medicine in Cobourg, Ontario. Reprint requests to: Cobourg Clinic, P.O. Box 86, Cobourg, ON. K9A 4K4.

ON THE FLOOR of several caves in Utah, southern U.S.A., archeologists have identified the eggs of Enterobius vermicularis (syn. Oxyuris vermicularis). The eggs, dated by radiocarbon as being 10,000 years old, were found in coprolites, or dried stool samples of prehistoric man.[1] This documents enterobiasis, or infestation with Enterobius vermicularis, as man's oldest proven parasitic infection.[2]

Enterobiasis remains a common problem today; it is estimated that 200 million of the world's population are infected—30-40 million in Canada and the United States alone.[6] Because of the ideal conditions for transfer of eggs provided by close contact, school age children are the most commonly infected. Adults and younger children become infected secondarily. The infection can reach epidemic proportions in institutions such as schools, camps, dormitories, etc.

Pinworms (also known as threadworms or seat worms) are the smallest of the family of round worms, or nematodes, to infect man. Unlike other nematodes such as Trichinella spiralis, Enterobius needs only man to complete its life cycle—an intermediate host is not required. Enterobius

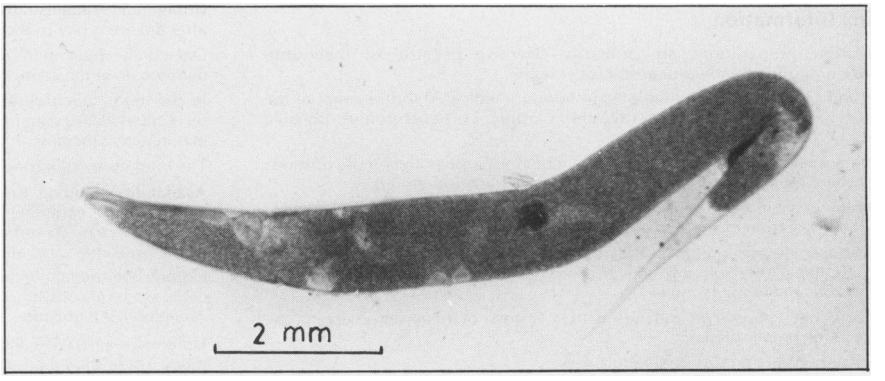

Fig. 1. Gravid female of Enterobius vermicularis. The gray, granular matter filling most of the body consists of eggs. Note the alae surrounding the anterior end, and the pointed, pin-like tail.

infects only humans; though a similar pinworm is parasitic in horses and dogs, man's pinworm is specific to man and will live in no other animal.

Life Cycle and Biology

The impressive biologic success of this small worm is largely due to the characteristics of its eggs, designed of course to assure perpetuation of the species. They are admirably suited to this task. The eggs are clear, colorless spheres, flattened on one side and very small—30-50 microns in size. They are thus visible to the naked eye only in clumps of thousands. The eggs are sticky when laid, and not easily dislodged by washing. Once dislodged, however, they are light enough to float on air currents and are widely dispersed by moving air produced, for example, by shaking out bedclothes. Eggs can similarly be inhaled, and later swallowed. Simply breathing the air in an infected child's room may produce infection.[6] Small wonder the worm has been bothering man for 10,000 years! Eggs can also be detected in vast numbers throughout the rooms of infected children—on the floor, windowsills, toys, draperies, etc. In one particular study, eggs were found in every room of the houses of infected children and at all levels from floor to ceiling.[3] Another study of infected children at a boy's school showed 119 eggs on each square foot of the walls of the school dining hall, 305 on the classroom walls and 5,000 on the lavatory walls.[4]

As well as being easily dispersed, the eggs are very hardy. In optimum conditions—a cool moist environment with little ventilation—eggs remain viable for up to three weeks. They tolerate wide ranges of temperature: two-thirds were still viable after 18 hours at −8 degrees C.[5] Eggs do not seem to tolerate heat well—perhaps one reason why the infestation is more common in temperate than tropical climates.

Pinworm ova are self contained biologic units, needing only six hours at body temperature to develop into infective larvae. Ova reach the mouth and nose by direct contact with infected surfaces such as fingers, by being inhaled and then swallowed, or on contaminated food, clothing or objects brought to the face and mouth. These objects are called fomites, and they function by simply holding the eggs on their surfaces. Household pets often play this role by carrying the eggs on their fur without actually harboring the adult worm in their bowels.[6] Veterinarians are quite reasonably upset when parents bring the family dog to be treated as a source for the children's pinworms.

After ingestion, the larvae mature in the small bowel and some 15-40 days later adult Enterobius appear in the bowel. The word Enterobius comes from the Greek words *enteros* meaning "bowel" and *bios* meaning "life". *Vermicularis* is a Latin term meaning simply "small worm". The adult, spindle-shaped worms are really tiny (females are 8-13 mm and males only 2-5 mm). They live in the cecum and lower ileum, with their heads attached to the mucosa. The male fertilizes the female and dies, being passed out in the stool without producing symptoms.

The female, however, does not let her host off quite as easily. When she is ready to lay her eggs, the female pinworm leaves the cecum and migrates the length of the colon to the rectal area. At night, she exits from the bowel by crawling out the anus in order that she may lay her eggs on the skin of the perineum. Biologically the female pinworm does this to obtain oxygen necessary for maturation of her ova.[6]

Females migrate only at night (reason unknown) in a fairly predictable sequence. In a boy's camp, where there was a standard routine of after-dinner play and then a standard time when lights were turned out, female pinworms were identified in many of the children at approximately the same time. The worms would not exit until the boys had been in bed for 30 minutes. The worms were observed to travel up to six centimeters from the anus to lay the eggs. At any one examination, 50% of the boys showed at least one gravid female pinworm laying its eggs.[5] Each female lays an average of 11,000 eggs and then becomes opaque and dies. Both the migration of the female and the clumps of eggs themselves are irritating, but the mechanism of producing such intense pruritus has never been explained.

Rarely, eggs in the perianal area will mature and re-enter the anus producing retroinfection, but this is not felt to be clinically significant.

Clinical Aspects

The poor, unassuming pinworm has been much maligned. They have been claimed to be the cause of nail biting, thumb sucking, tooth grinding, nose picking and nymphomania.[7] Many infections are asymptomatic,[7] but in keeping with the pinworm's long history, Hippocrates himself described the nocturnal pruritus ani which is the usual presenting complaint. This

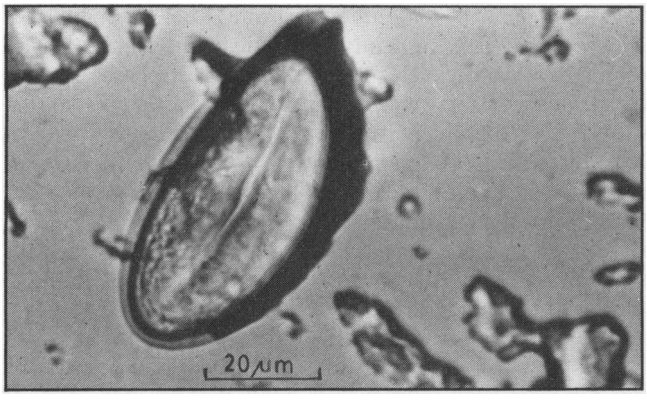

Fig. 2. Adult male of Enterobius vermicularis. Note alae surrounding the anterior end (left), the blunt posterior end, and the smaller size.

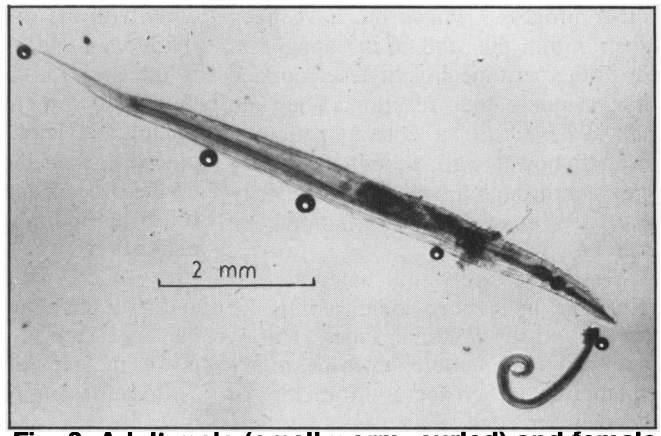

Fig. 3. Adult male (small worm; curled) and female of Enterobius vermicularis.

pruritus may produce such secondary lesions as mechanical dermatitis of the perianal or vulvar tissues. Children, whose limited command of language combines with their inexperience of symptoms, complain of soreness in the anal area, unable to differentiate pruritus from pain. Very young children often have only a non-specific insomnia, a vague restlessness or repeated awakenings, not responding to the usual soothings and supplications. Mothers will often only report that the child is fussy at night. The periodicity of symptoms, the fact that the child is usually well during the day, a normal physical, and a high index of suspicion help suggest the diagnosis in young children.

The presence of large numbers of adult worms in the bowel has been supposed to cause abdominal pain, constipation and even tenesmus, but at least the first two symptoms are common and often difficult to explain in children. These symptoms are rare for pinworms, and should prompt the physician to rule out other, more serious conditions.

Unusual Manifestations

Occasionally pinworms and their ova find themselves the centre of the pathologist's attention when they appear in other tissues.[8] Enterobius is often seen in the lumen of the appendix removed for acute inflammation (remember, the adults usually live in the cecum immediately adjacent). A large number of pinworms may clump together and form a bolus which obstructs the appendix, causing appendiceal colic. However, pinworms are usually present in pathological specimens of acute appendicitis as innocent bystanders in an organ inflamed by another process.[9] Pinworms have been seen within the wall of the appendix, or in the peritoneal cavity, surrounded by granulomatous reaction. They are not believed to be able to penetrate normal bowel wall, though they may migrate through a wall whose integrity has been broached by an inflammatory process.

Pinworms rarely will enter the vagina and have been identified in the uterus and the fallopian tubes. This is believed to be the female worm simply wandering in her nocturnal attempt to deposit her eggs. Pinworms may thus cause vaginitis, but again this is not common.[10]

Enterobius has also been identified in granulomata in the liver, nodules in the lung and even in a suppurating abscess of the female breast, but these are quite unusual and of little clinical significance.[11-13]

More interesting, however, is the relationship between pinworms and recurring cystitis and secondary enuresis in young girls. There is some evidence that pinworm infection may be a cause of secondary enuresis. Sachdev and Howards[14] reported that five girls with recurring cystitis and negative cultures were all cured with treatment of their pinworms. Mayers and Purvis[15] found pinworms in four out of six girls with secondary enuresis; three of these were cured after therapy for their worms. Though the number of patients involved is small, the results are suggestive. Similarly, Kropp et al.[16] found a higher incidence of enteric organisms on the introital area and pinworm ova on the perianal skin in young girls with recurring cystitis, suggesting pinworms may be an easily treatable factor in this condition. Enterobiasis must therefore be kept in mind when treating either of these problems, especially when bacterial infection is not the cause.

Diagnosis

To see a female pinworm laying eggs in its natural environment is one of parenting's most awesome moments. With the child on his back and buttocks spread, a bright light will often reveal the minute thread-like worms, particularly when the child is symptomatic. The worms are often very active, moving like an inch worm away from the anus. The eggs themselves can only be seen in clumps of thousands, and then only with difficulty with the naked eye, but can easily be seen under the microscope. This is the basis of the standard pinworm tape test (also called Hall or National Institute of Health swab).[17] Scotchtape placed against the anal area will pick up the ova. Collection is most successful in the morning, before washing or defecation. The tape is then placed sticky side down on a microscope slide and with the help of a drop of toluene, the eggs can be identified under low power magnification.

Because females do not exit each night to lay eggs, and because the number of eggs vary, the test is most accurate if done each morning for several successive days. In infected children, 50% are found to be positive with the tape test on one single morning, but this rises to 90% after three successive morning swabbings, and 99% after five successive morning swabs.[6]

Parents can be instructed to examine their children for adult worms and also to collect three successive morning samples to be brought to the physician's office for examination. Occasionally, physicians will be forced to treat without confirming the diagnosis, but this should be only as a last resort.

Few other tests are helpful in diagnosing enterobiasis. Examination of the stool itself shows eggs in fewer than 5% of cases. The female does not lay eggs in stool, but on the perianal skin. Ordering stool samples for ova and parasites will diagnose only one infected person in 20. No blood tests are helpful in making the diagnosis. Eosinophilia may be present, but is neither constant nor diagnostic.

Treatment

Adult Enterobius live only three to six weeks; it is therefore possible to break the cycle of infection by impeccable hygiene. However, the worm is so well adapted to its host, and drug therapy so effective, that many authors feel this approach is impractical.[6, 7] A few commonsense hygienic precautions seem reasonable and become particularly important in recurring cases.

It seems prudent to advise that the fingernails of children be trimmed, the bed clothes be laundered (eggs are killed in the heat of the household clothes dryer), dogs and cats be washed and the house cleaned, particularly bedrooms. Hands of all family members should be washed frequently. Obviously the family physician must carefully dispense this advice, adapting the particulars to the personalities of his patients, and remembering that some authors[6] minimize the role of hygiene in treating the infestation.

It is usual to treat all family members at once because of the ubiquitous nature of the infecting eggs. Retreatment of the entire family in two weeks may also be advisable, since the drugs kill adult worms, not eggs. If one infected family member spreads eggs to the other members of the family, it will be a matter of two to three

weeks before those eggs become adult worms and thus amenable to treatment.

Though hygiene plays a role, drug therapy is the treatment of choice. There are a wide variety of drugs available, listed below in order of preference.

Mebendazole (Vermox and others)

This relatively new drug inhibits the uptake of glucose, effectively starving the parasite. This effect is not species specific; mebendazole is thus a broad spectrum antihelmintic. It is the drug of choice for Trichuris (whip worm), and is also effective against Ascaris (roundworm), and two species of hook worm, as well as Enterobius.[18] About 10% of the drug is absorbed and excreted in the urine. Side-effects are infrequent, but nausea, diarrhea, vomiting, dizziness and headache do occur.[19] Elevation of liver enzymes has been reported. The drug is embryotoxic and teratogenic in rats, so its use in pregnancy is not advised. Because of insufficient data, the manufacturer does not recommend its use in children under two years of age.

A single 100 mg tablet is the suggested treatment for both adults and children aged two to 12. The same dose can be used because there is poor absorption of the drug and increased fecal turnover in children. Cure rates of 90-100% are reported. The drug's advantages include few side effects, limited systemic absorption and ease of administration due to standard dose.[20] It is also quite active against other forms of parasitic infection.

Pyrantel Pamoate
(Combantrin and others)

This drug kills adult worms by neuromuscular blockade.[21] It is poorly absorbed: less than 15% is excreted in the urine. The commonest adverse reactions include vomiting, abdominal pain, diarrhea, headache, dizziness and rash. All of these are uncommon. The drug has not been studied in pregnancy; nor should it be used in children less than one year of age. It is administered as a single dose of 11 mg/kg and is supplied as a suspension or tablet.

Pyrvinium Pamoate
(Vanquin, Pamovin and others)

This drug is a cyanine dye derivative which works by inhibiting oxygen uptake of adult worms.[22] It retains some dye characteristics; patients should be warned that stains from spilling the medicine are difficult to remove. The tablets should not be chewed but swallowed whole to avoid staining of the teeth. Patients should similarly be warned that stools will be stained red. The drug is usually well tolerated, but vomiting (also stained red) and abdominal cramping are the commonest side effects. The drug is not absorbed, and is administered in a single dose according to the patient's weight. The drug is available in suspension and tablets, and the standard dosage is 5 mg/kg. It is the drug of choice for infants and pregnant women.

Piperazine (Antepar and others)

This drug produces flaccid paralysis of the adult worms, which are then evacuated from the bowel by normal peristalsis.[22] The drug is readily absorbed and subsequently excreted in the urine. Gastrointestinal upset is again the commonest side effect, but transient neurological effects and urticaria are seen. Piperazine has been used without ill effect in pregnancy, though most manufacturers suggest it not be used.[23] Lethal doses cause convulsions and respiratory depression. The drug is contraindicated in epileptics and should be used with caution in patients with impaired renal function. There are several different dosage schedules, but daily doses of 65 mg/kg each day for eight days results in 95-100% cure. The drug may also be used in a single dose. It is available in tablets, wafers or syrup. Its disadvantages are its dosage schedule and its moderate absorption into the systemic circulation (up to 50%).

Conclusion

Enterobiasis is a commonly encountered problem in family practice. School age children show the highest incidence of infection, though both adults and younger children may have enterobiasis. The commonest symptom in older children and adults is pruritis ani, but in young children the condition may present only as a nonspecific disturbance in sleep pattern. Though usually susceptible to drug therapy, an appreciation of the particulars of the parasite's life cycle is important in preventing recurrence of infection. ◉

Acknowledgement

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